

General Description

The Sanrise SRC65R330EC is a high voltage power MOSFET, fabricated using advanced super junction technology. The resulting device has extremely low on resistance, low gate charge and fast switching time, making it especially suitable for applications which require superior power density and outstanding efficiency.

The SRC65R330EC break down voltage is 650V and it has a high rugged avalanche characteristics. The SRC65R330EC is available in TO-252 ,TO-220F, TO-262, TO-263-2,TO-220F Narrow and TO-220C packages .

Features

- Ultra Low $R_{DS(ON)} = 330m\Omega @ V_{GS} = 10V$.
- $V_{ds}@T_{jmax}=700v$
- Ultra Low Gate Charge, $Q_g=27.2nC$ typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved Design (*SnowMOS™ Gen.2*)
- Non-automotive Qualified

Application

- TV Power
- High Performance Charger / Adapter

Ordering Information

	SRC65R330EC□□-□		
Circuit Type			E: Lead Free
Package			G: Green
D1-G: TO-251			Blank: Tube
D: TO-252 S2: TO-263-2			TR: Tape & Reel
TF: TO-220F TFN: TO-220F Narrow			
TC: TO-220C TS: TO-262			

Symbol

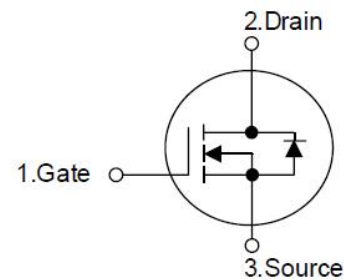


Figure 1 Symbol of SRC65R330EC

Package Type

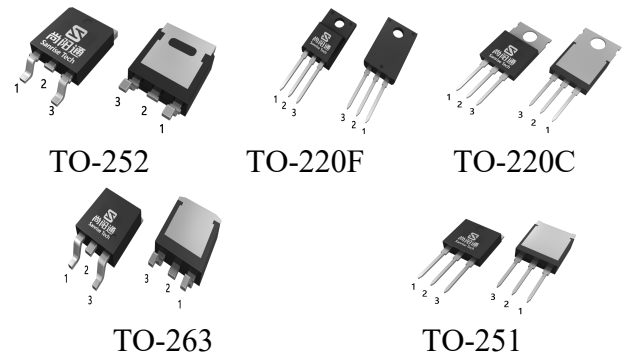


Figure 2 Package Types of SRC65R330EC

Package	Part Number	Marking ID	Packing Type
TO-252	SRC65R330ECDTR-G	SRC65R330ECDG	Tape & Reel
TO-263-2	SRC65R330ECS2TR-G	SRC65R330ECS2G	Tape & Reel
TO-220F	SRC65R330ECTF-G	SRC65R330ECTFG	Tube
TO-262	SRC65R330ECTS-G	SRC65R330ECTSG	Tube
TO-220C	SRC65R330ECTC-G	SRC65R330ECTCG	Tube
TO-251	SRC65R330ECD1-G	SRC65R330ECD1G	Tape & Reel
TO-220F Narrow	SRC65R330ECTFN-G	SRC65R330ECTFNG	Tube

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Drain-Source Voltage (Note2)	V_{DSS}	650	V
Gate-Source Voltage (static)	V_{GSS}	±20	V
Gate-Source Voltage (dynamic), AC ($f > 1$ Hz)	V_{GSS}	±30	V
Continuous Drain Current	$T_C=25^{\circ}C$	12.5 (Note3)	A
	$T_C=100^{\circ}C$	6.9	
	$T_C=125^{\circ}C$	4.7	
Pulsed Drain Current (Note 4)	I_{DM}	37.5	A
Avalanche Energy, Single Pulse (Note 5)	E_{AS}	109	mJ
Avalanche Energy, Repetitive (Note 4)	E_{AR}	0.1	mJ
Avalanche Current, Repetitive (Note 4)	I_{AR}	1.8	A
Continuous Diode Forward Current	I_S	12.5	A
Diode Pulse Current	$I_{S,PULSE}$	37.5	A
Power Dissipation ($T_C=25^{\circ}C$, TO-220F, TO-220F Narrow)	P_{tot}	30	W
Power Dissipation ($T_C=25^{\circ}C$, TO-252, TO-263-2, TO-262, TO-220C, TO-251)	P_{tot}	75	W
Operating Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	-55 to 150	°C
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	°C

Note:

1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. For voltage spike during switching.
3. Duty=70%
4. Repetitive Rating: Pulse width limited by maximum junction temperature
5. $I_{AS} = 1.8A$, $V_{DD} = 60V$, $R_G = 25\Omega$, Starting $T_J = 25^{\circ}C$

Thermal Resistance

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	R _{thJC}			4.05	°C /W
	TO-220F Narrow				4.05	
	TO-252				1.65	
	TO-262				1.65	
	TO-263-2				1.65	
	TO-220C				1.65	
	TO-251				1.65	
Thermal resistance, Junction-to-Ambient	TO-220F	R _{thJA}			70	°C /W
	TO-220F Narrow				70	
	TO-252				62	
	TO-262				62	
	TO-263-2				62	
	TO-220C				62	
	TO-251				62	

Electrical Characteristics

$T_J = 25^\circ\text{C}$, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	650			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$			1	μA
Gate-Body Leakage Current	Forward	$I_{GSSF}, V_{GS}=30V, V_{DS}=0V$			100	nA
	Reverse	$I_{GSSR}, V_{GS}=-30V, V_{DS}=0V$			-100	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.7	3.5	4.3	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=5.5A$		290	330	mΩ
Gate Resistance	R_G	f=1MHz, Open Drain		6.5		Ω
Dynamic Characteristics						
Input Capacitance	C_{ISS}	$V_{DS}=50V, V_{GS}=0V,$ f=1MHz		470		pF
Output Capacitance	C_{OSS}			48		
Reverse Transfer Capacitance	C_{RSS}			28		
Effective output capacitance, energy related ^{NOTE5}	$C_{O(er)}$	$V_{GS}=0V,$ $V_{DS}=0\dots 480V$		24		pF
Effective output capacitance, time related ^{NOTE6}	$C_{O(tr)}$			110		
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=400V, I_D=5.5A$ $R_G=10\Omega, V_{GS}=10V$		11		ns
Rise Time	t_r			12		
Turn-off Delay Time	$t_{d(off)}$			41		
Fall Time	t_f			15		
Gate Charge Characteristics						
Gate to Source Charge	Q_{gs}	$V_{DD}=480V, I_D=5.5A$ $V_{GS}=0$ to 10V		6.0		nC
Gate to Drain Charge	Q_{gd}			13.4		
Gate Charge Total	Q_g			27.2		
Gate Plateau Voltage	$V_{plateau}$			5.7		V
Reverse Diode Characteristics						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_{SD}=5.5A$		0.83	1.1	V
Reverse Recovery Time	t_{rr}	$V_R=400V, I_F=5.5A$ $dI_F/dt=100A/\mu s$		214		ns
Reverse Recovery Charge	Q_{rr}			1.73		μC
Peak Reverse Recovery Current	I_{rrm}			16.2		A

Note:

- $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 480V
- $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 480 V

Typical Performance Characteristics

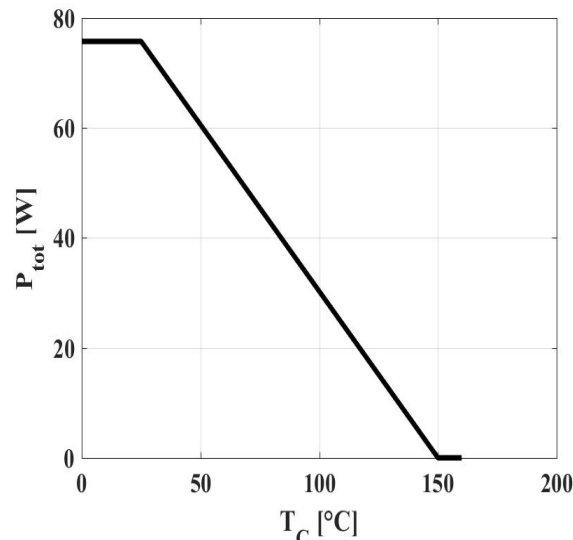
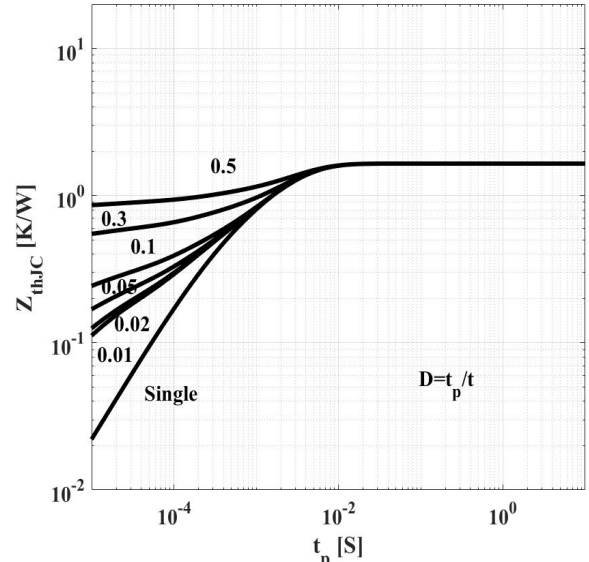
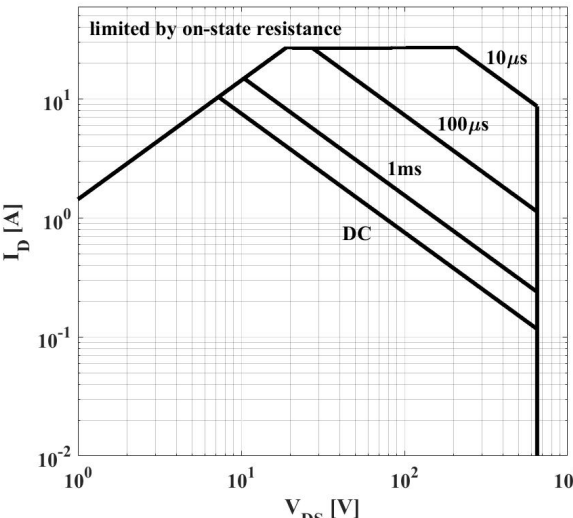
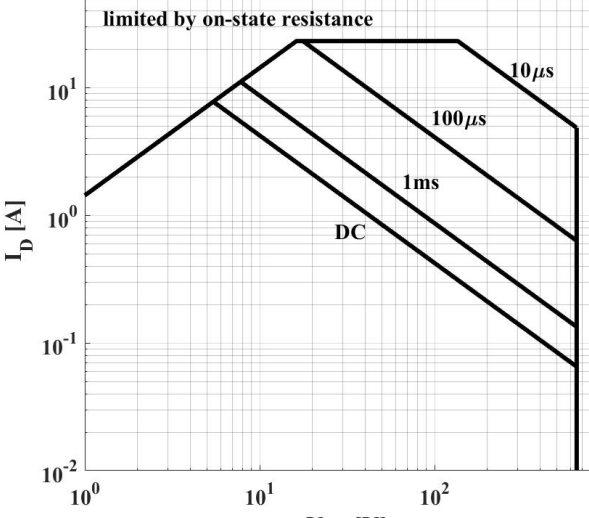
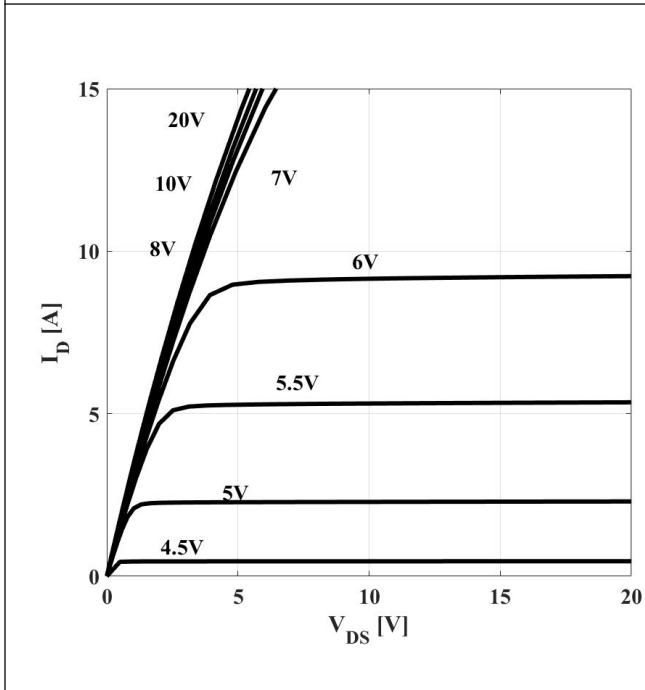
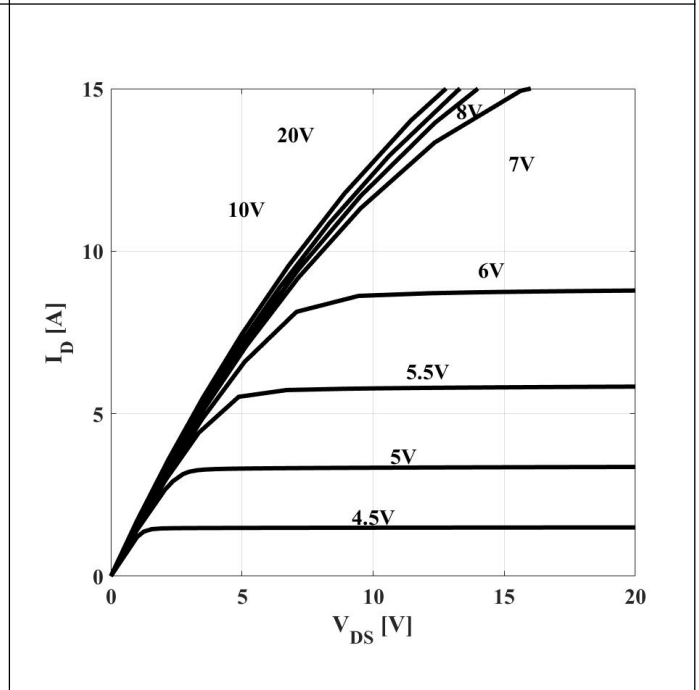
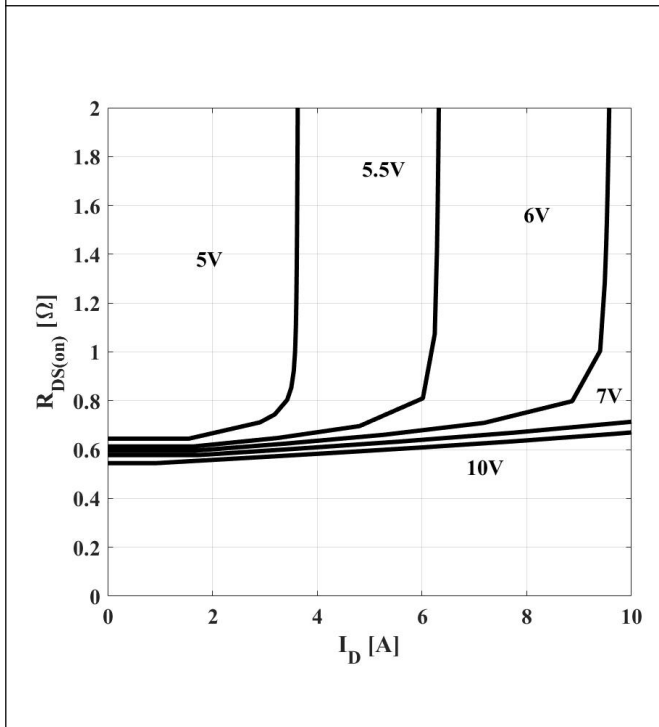
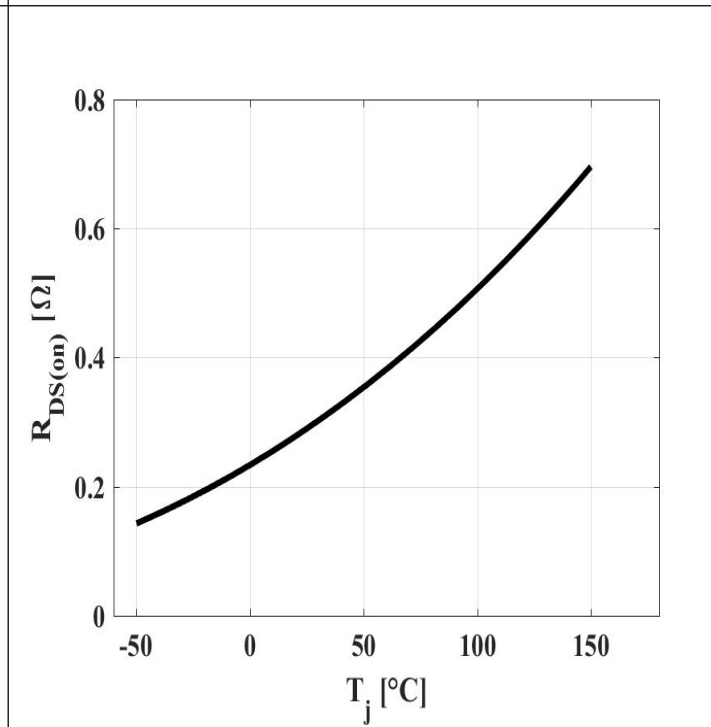
<p>Figure 3: Power Dissipation</p>  <p>$P_{tot} = f(T_c)$</p>	<p>Figure 4: Max. Transient Thermal Impedance</p>  <p>$Z_{(th)JC} = f(t_p)$; parameter: $D = t_p/T$</p>
<p>Figure 5: Safe Operating Area</p>  <p>$I_D = f(V_{DS})$; $T_c = 25^\circ\text{C}$; $V_{GS} > 7\text{V}$; parameter t_p</p>	<p>Figure 6: Safe Operating Area</p>  <p>$I_D = f(V_{DS})$; $T_c = 80^\circ\text{C}$; $V_{GS} > 7\text{V}$; parameter t_p</p>

Figure 7: Typ. Output Characteristics

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 8: Typ. Output Characteristics

 $I_D = f(V_{DS}); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 9: Typ. Drain-Source On-State Resistance

 $R_{DS(ON)} = f(I_D); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 10: Typ. Drain-Source On-State Resistance

 $R_{DS(ON)} = f(T_j); I_D = 5.5\text{A}; V_{GS} = 10\text{V}$

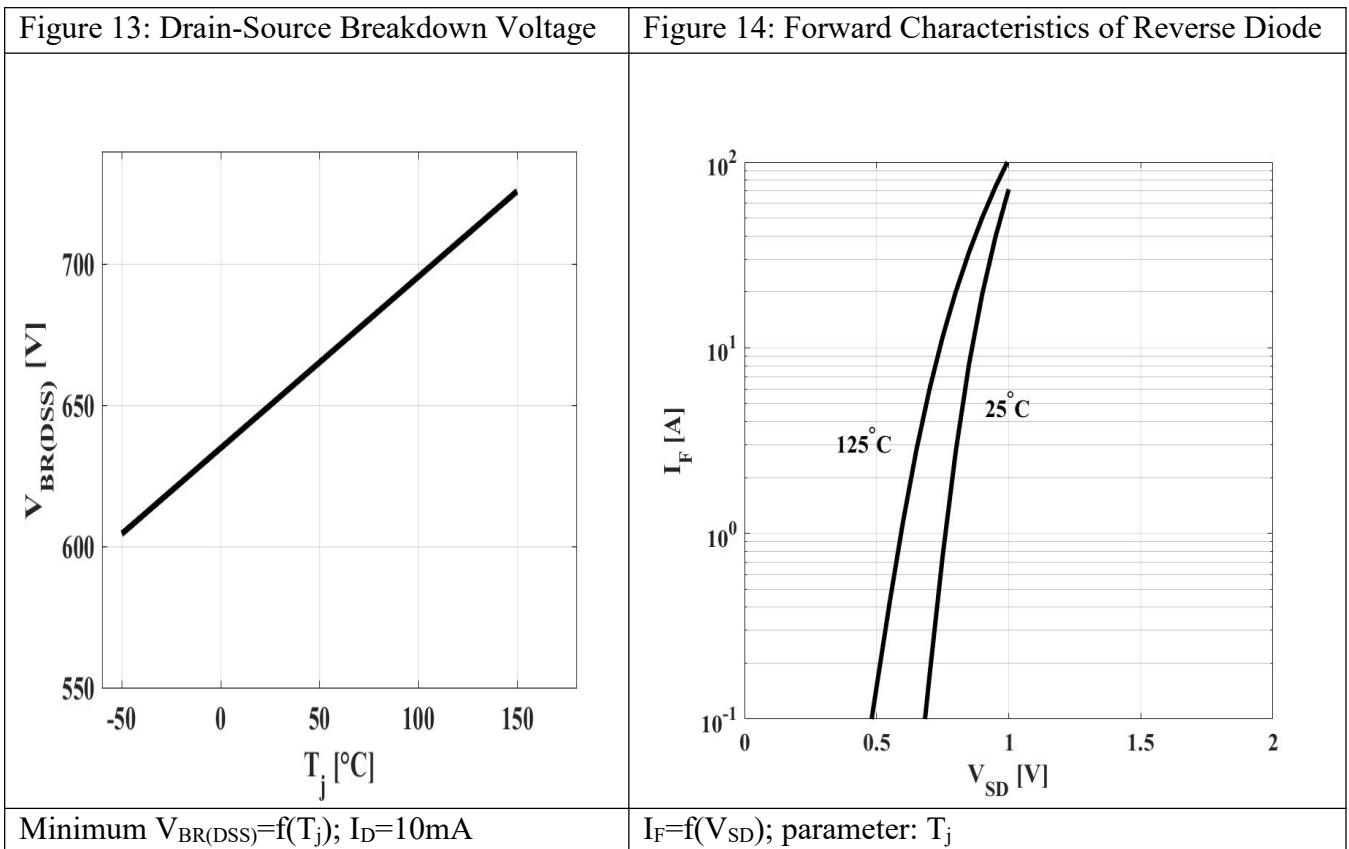
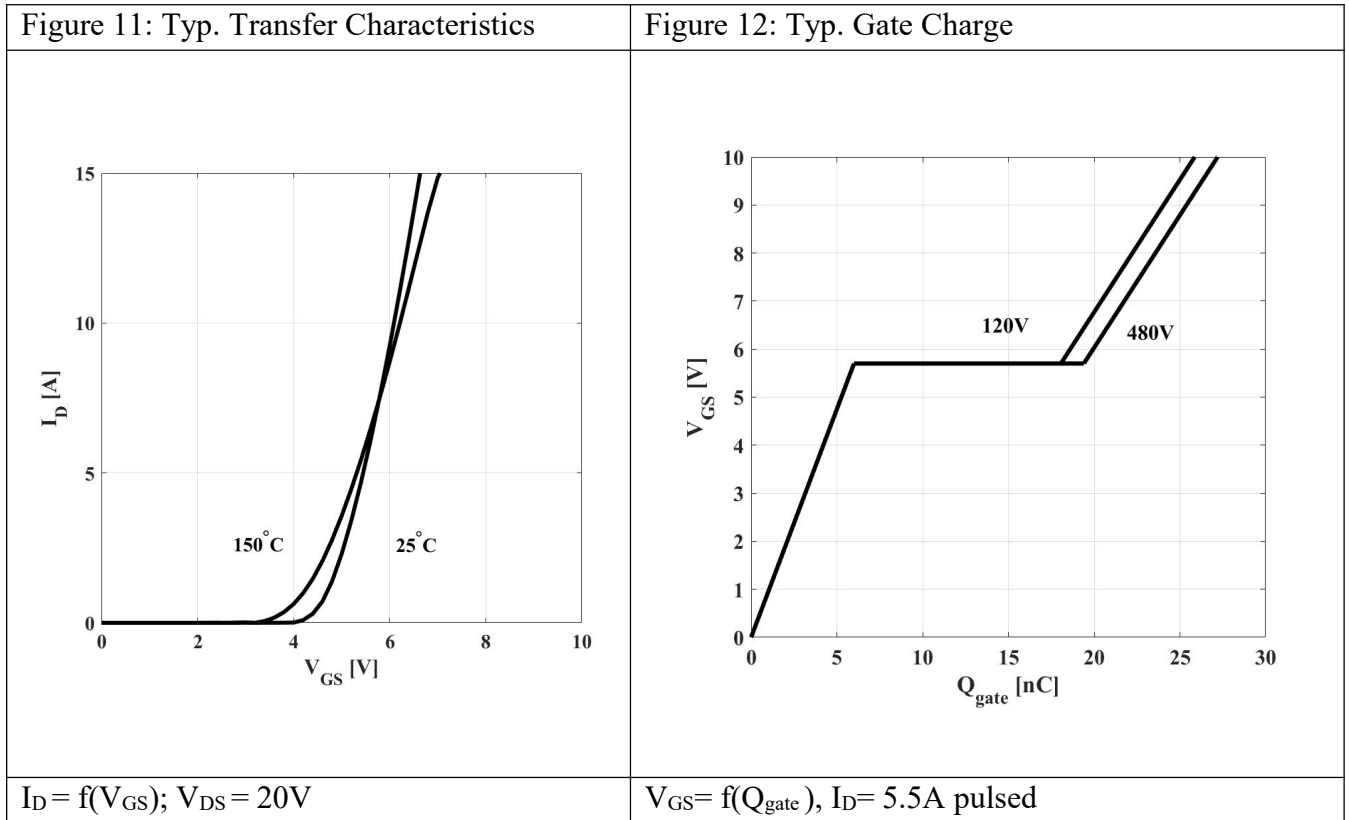
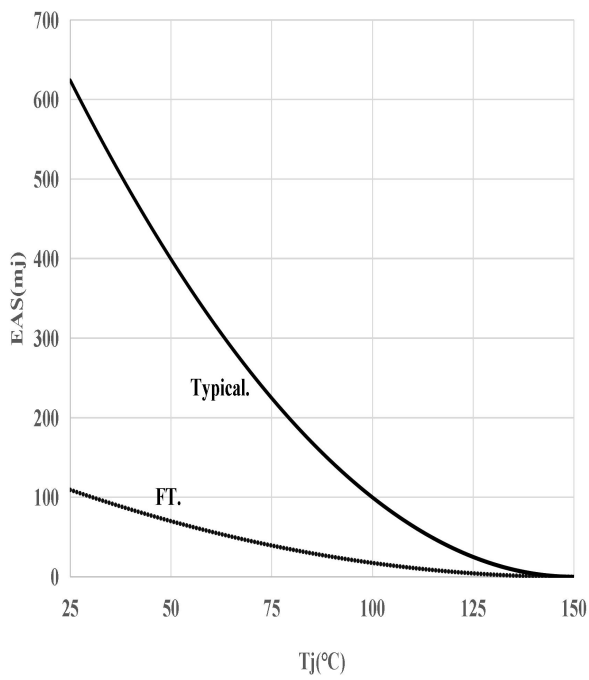
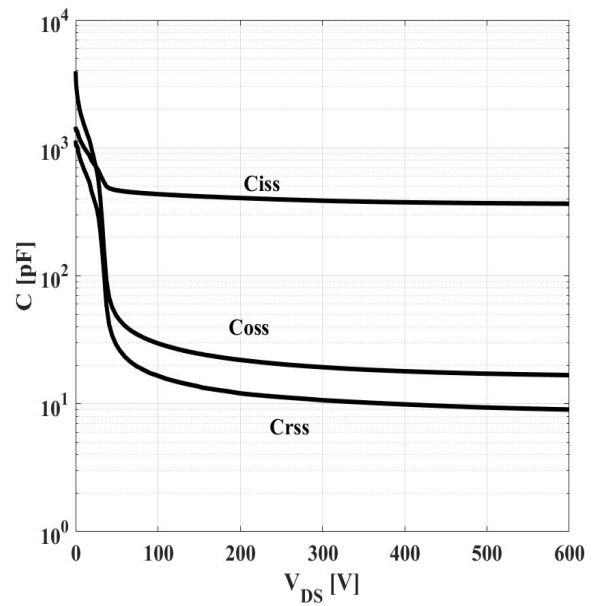
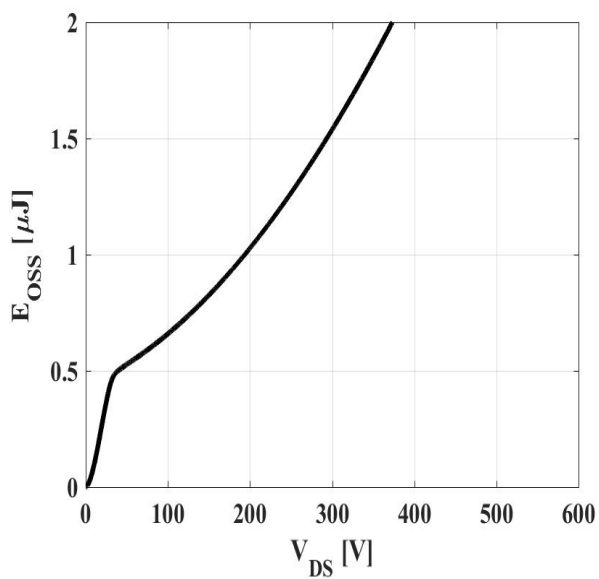


Figure 15: Avalanche Energy


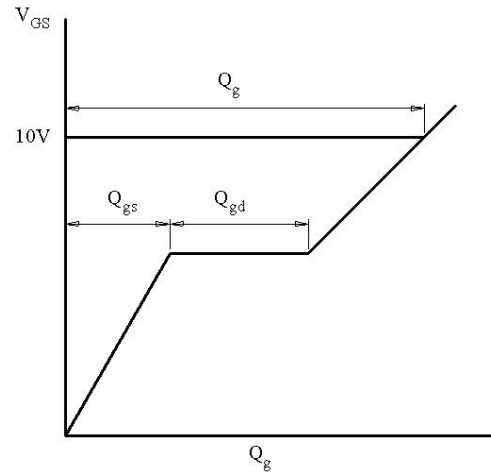
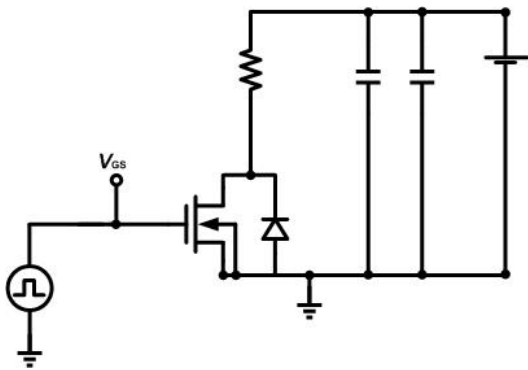
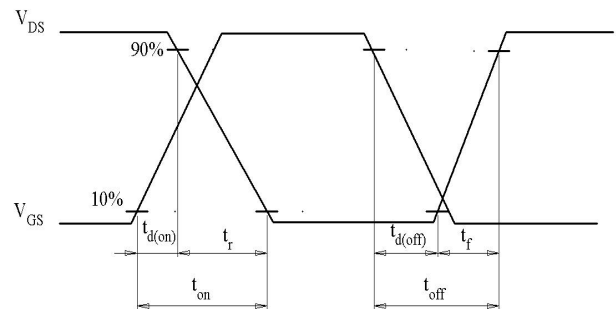
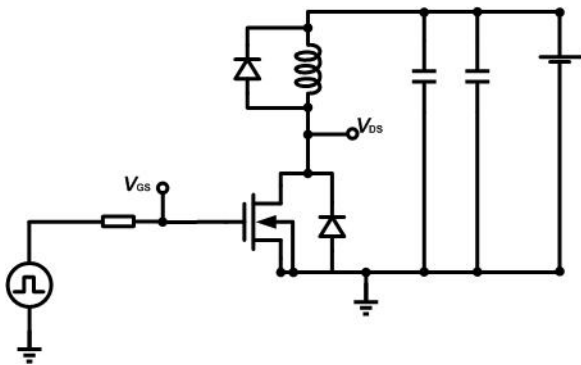
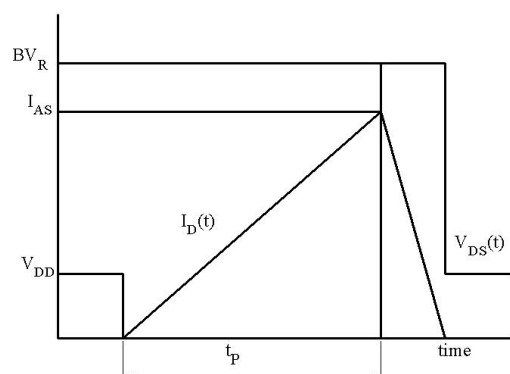
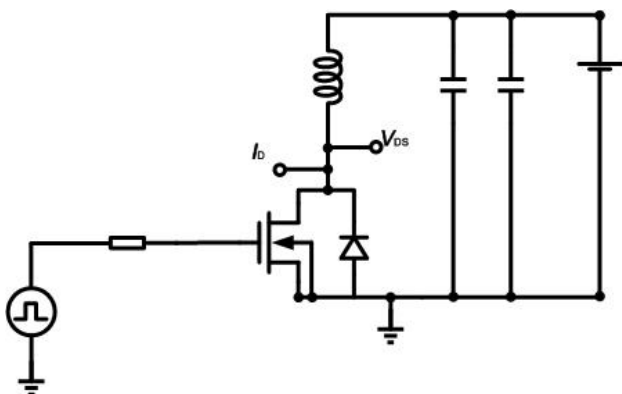
$$E_{AS}=f(T_j); I_D=1.8A; V_{DD}=60V$$

Figure 16: Typ. Capacitances


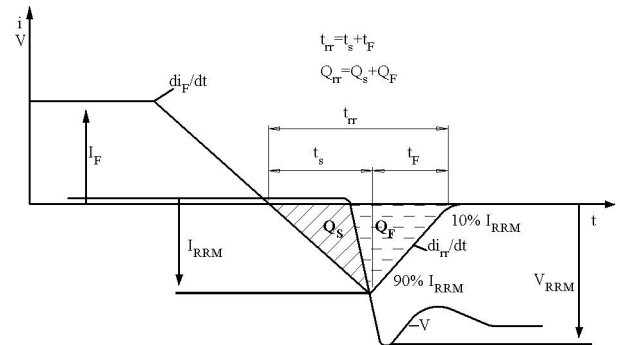
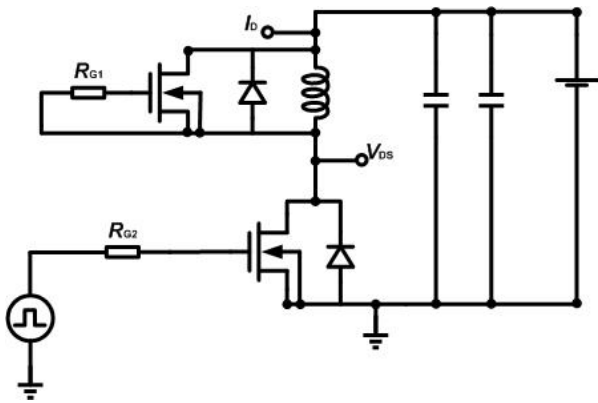
$$C=f(V_{DS}); V_{GS}=0; f=1MHz$$

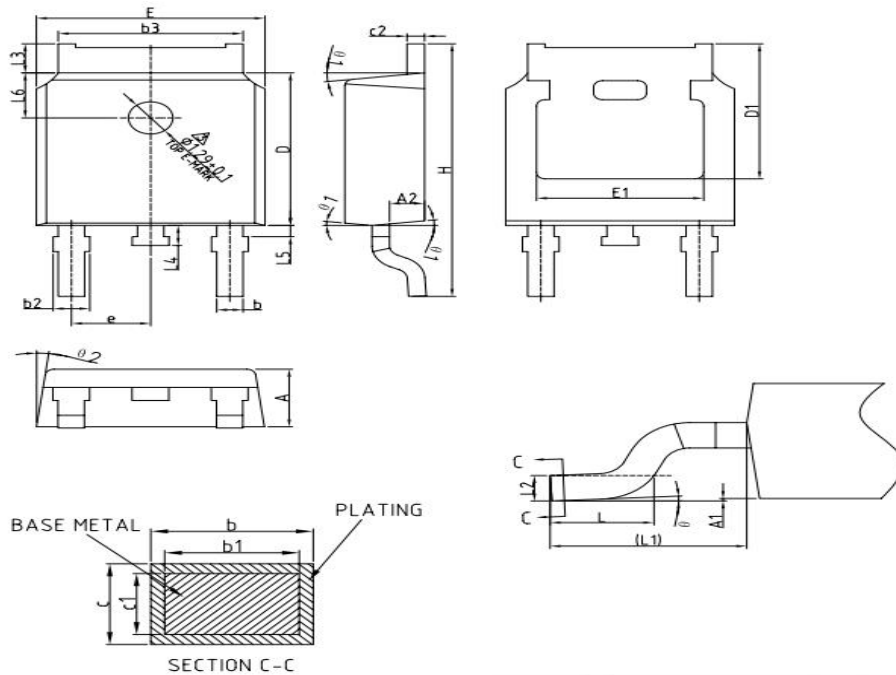
Figure 17: Coss Stored Energy


$$E_{OSS}=f(V_{DS})$$

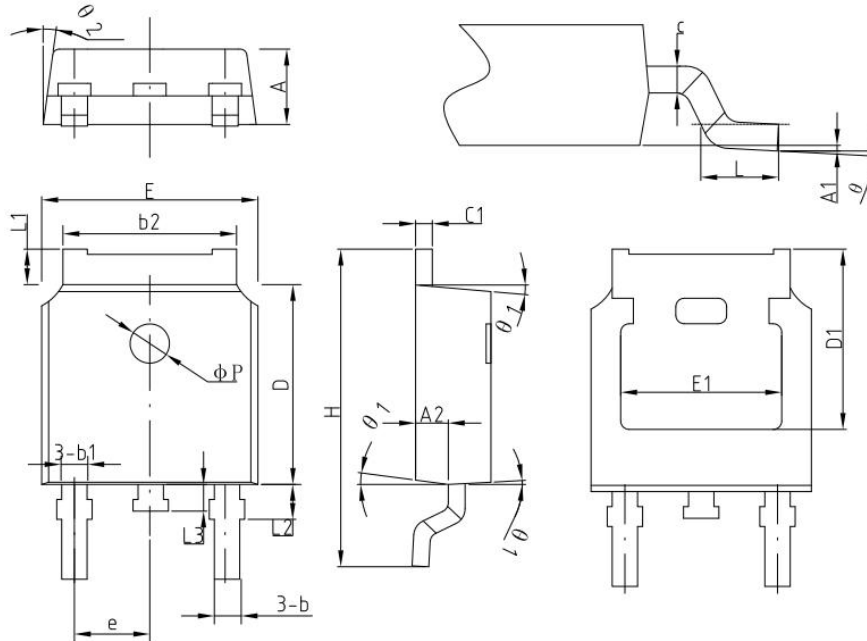
Test Circuits
1. Gate Charge Test Circuit & Waveform

2. Switch Time Test Circuit

3. Unclaimed Inductive Switching Test Circuit & Waveforms


4. Test Circuit and Waveform for Diode Characteristics



Mechanical Dimensions
TO-252 (Package 1)
Unit: mm


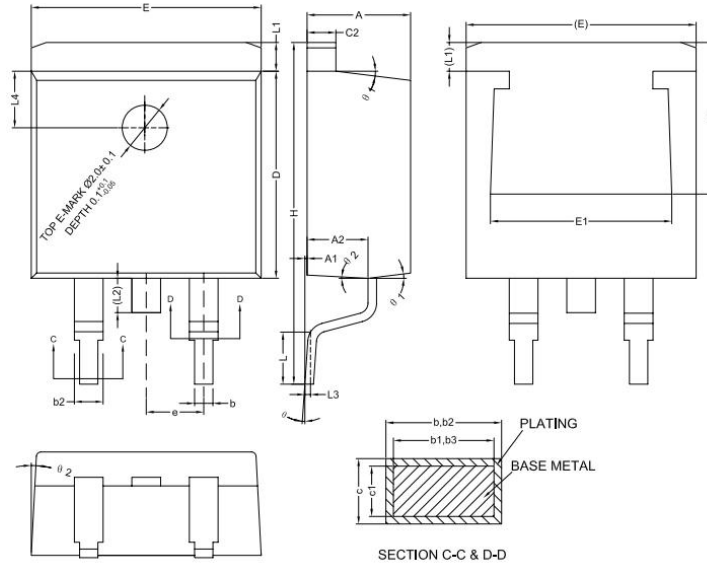
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.10
A2	0.90	1.01	1.10
b	0.72	-	0.85
b1	0.71	0.76	0.81
b2	0.72	-	0.90
b3	5.13	5.33	5.46
c	0.47	-	0.60
c1	0.46	0.51	0.56
C2	0.47	-	0.60
D	6.0	6.10	6.20
D1	5.25	-	-
E	6.50	6.60	6.70
E1	4.70	-	-
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90REF		
L2	0.51BSC		
L3	0.90	-	1.25
L4	0.60	0.80	1.00
L5	0.15	-	0.75
L6	1.80REF		
Ø	0°	-	8°
Ø1	5°	7°	9°
Ø2	5°	7°	9°

Mechanical Dimensions
TO-252 (Package 2)
Unit: mm


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0	-	0.127
A2	0.90	1.01	1.10
b	0.635	0.76	0.86
b1	-	0.76	-
b2	5.2	5.33	5.46
c	0.47	0.50	0.60
c1	0.47	0.50	0.60
D	6.0	6.10	6.20
D1	-	5.30	-
E	6.50	6.60	6.70
E1	-	4.83	-
e	2.286(BSC)		
H	9.70	10.10	10.40
L	1.40	1.50	1.70
L1	0.90	-	1.25
L2	-	1.0	-
L3	-	0.8	-
φP	-	1.2	-
θ	0°	-	8°
θ1	5°	7°	9°
θ2	5°	7°	9°

Mechanical Dimensions
TO-263-2 (Package 1)

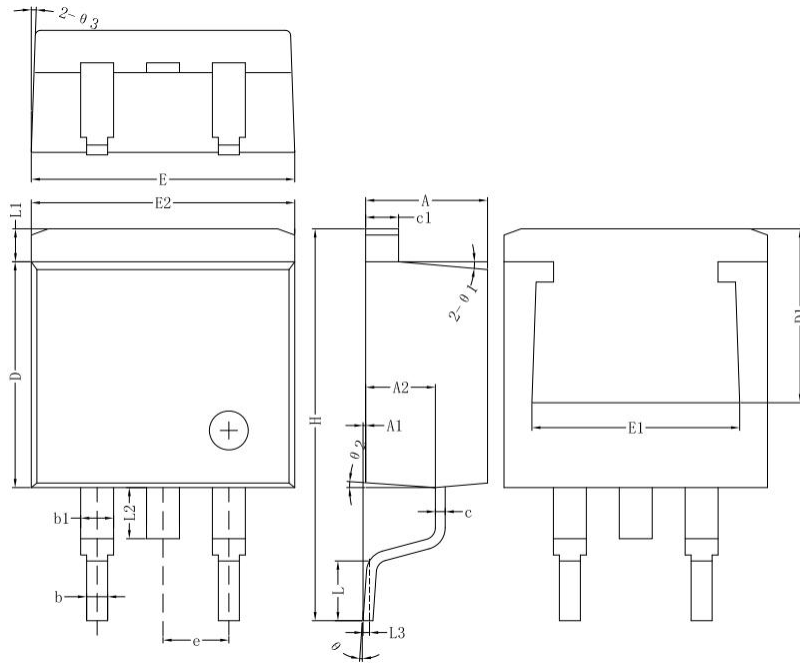
Unit: mm



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.57	4.70
A1	0.00	0.10	0.25
A2	2.59	2.69	2.79
b	0.77	-	0.90
b1	0.76	0.81	0.86
b2	1.23	-	1.36
b3	1.22	1.27	1.32
c	0.34	-	0.47
c1	0.33	0.38	0.43
c2	1.22	-	1.32
D	9.05	9.15	9.25
D1	6.60	-	-
E	10.06	10.16	10.26
E1	7.80	-	8.20
e	2.54(BSC)		
H	14.70	15.10	15.50
L	2.00	2.30	2.60
L1	1.17	1.27	1.40
L2	-	-	1.75
L3	0.25BSC		
L4	2.00REF		
θ	0°	-	8°
θ1	5°	7°	9°
θ2	1°	3°	5°

Mechanical Dimensions
TO-263-2 (Package 2)

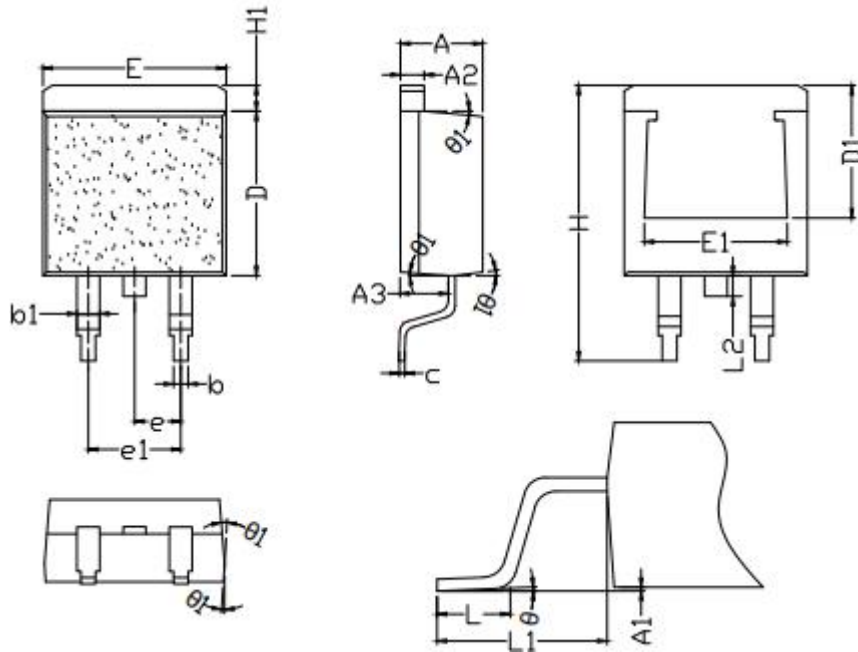
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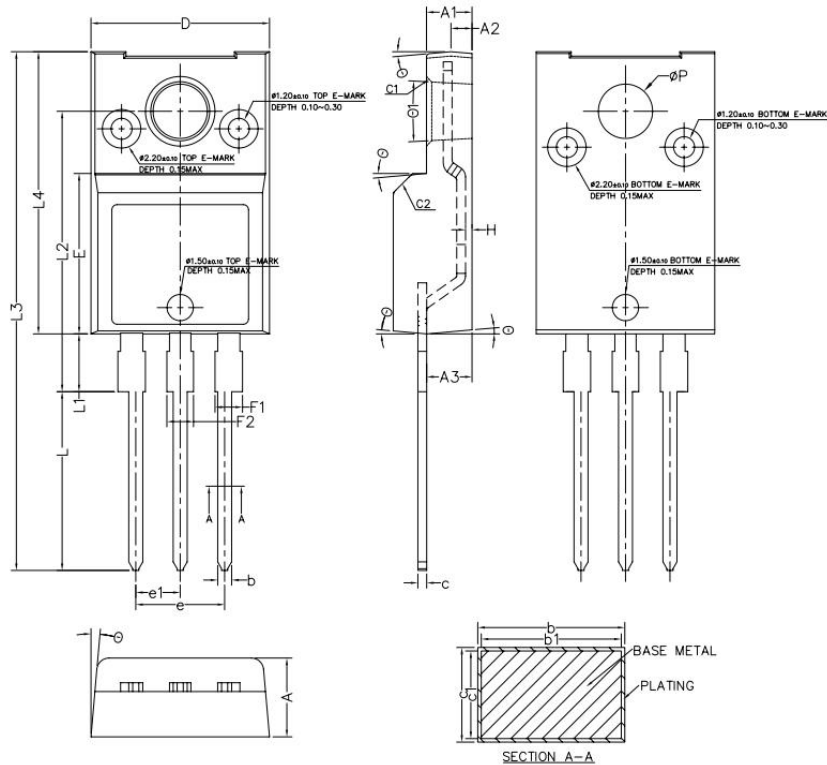
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.55	4.70	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.71	0.81	0.96
b1	-	1.27	-
c	0.36	0.38	0.61
c1	1.17	1.27	1.37
D	8.55	8.70	8.85
D1	-	7.2	-
E	10.01	10.16	10.31
E1	-	7.80	-
E2	9.98	10.08	10.18
e	-	2.54	-
H	14.70	15.10	15.50
L	2.00	2.30	2.70
L1	1.17	1.27	1.40
L2	-	-	2.20
L3	-	0.25BSC	-
θ	0°	-	8°
θ1		5°	
θ2		4°	
θ3		4°	

Mechanical Dimensions
TO-263-2 (Package 3)

Unit: mm



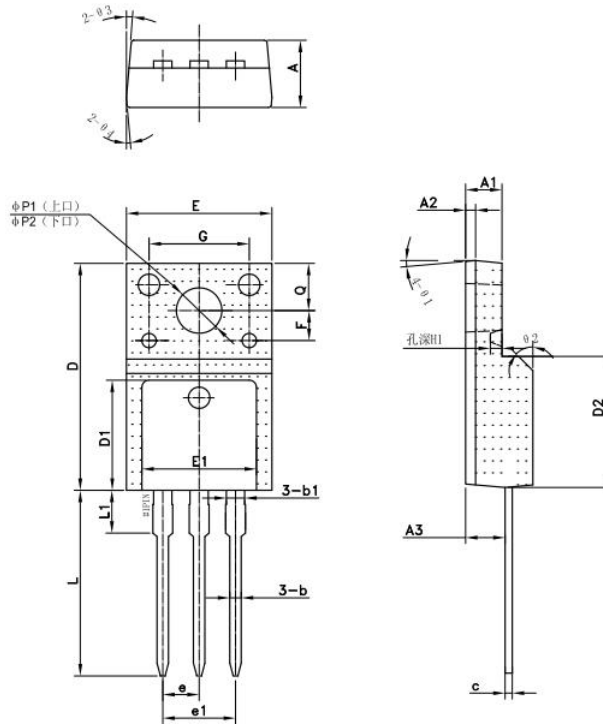
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.42	4.52	4.62
A1	0.00	0.10	0.25
A2	1.24	1.27	1.32
A3	2.50	2.60	2.70
b	0.77	0.81	0.84
b1	1.23	1.28	1.41
c	0.33	0.38	0.43
D	8.80	8.95	9.10
D1	7.2REF		
E	9.92	10.07	10.22
E1	7.85REF		
e	2.50	2.54	2.58
e1	5.08REF		
H	14.80	15.10	15.30
H1	1.12	1.28	1.42
L	2.10	2.23	2.36
L1	4.55	4.75	4.95
L2	1.10	1.30	1.50
θ	0°	2°	5°
θ1	3°	-	5°

Mechanical Dimensions
TO-220F (Package 1)
Unit: mm


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.50	4.60
A1	2.50	2.60	2.70
A2	1.10	1.20	1.30
A3	2.49	2.59	2.69
b	0.76	-	0.89
b1	0.75	0.80	0.85
c	0.46	-	0.59
c1	0.45	0.50	0.55
C1	0.20	0.30	0.40
C2	1.00	1.10	1.20
D	10.10	10.20	10.30
E	9.05	9.15	9.25
e	4.98	5.08	5.18
e1	2.44	2.54	2.64
F1	1.22	-	1.60
F2	1.17	-	1.55
H	0.32	0.37	0.42
L	10.00	10.20	10.40
L1	3.15	3.30	3.45
L2	15.85	16.00	16.15
L3	29.30	29.60	29.90
L4	16.00	16.10	16.20
P	3.00	3.10	3.20
θ	3°	5°	7°
θ1	4°	6°	8°

Mechanical Dimensions
TO-220F (Package 2)

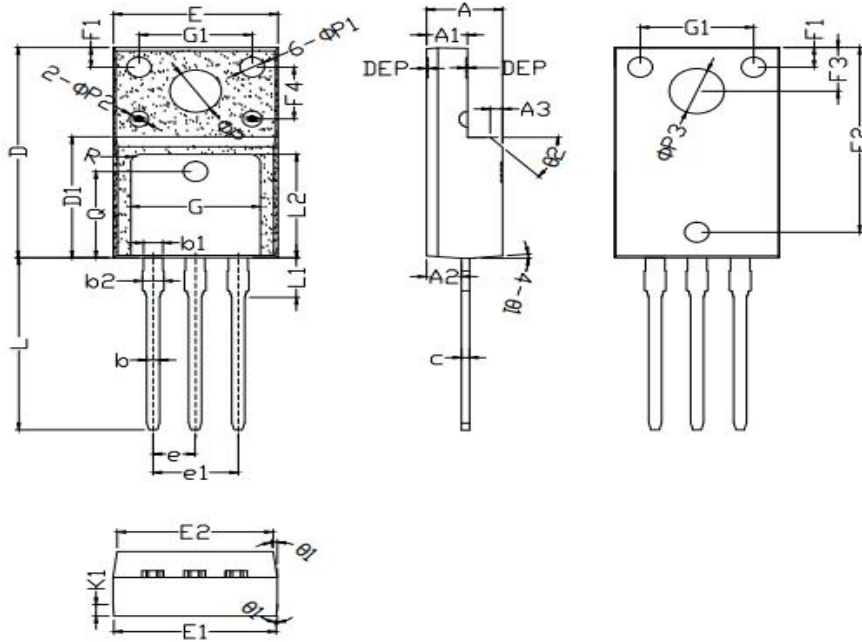
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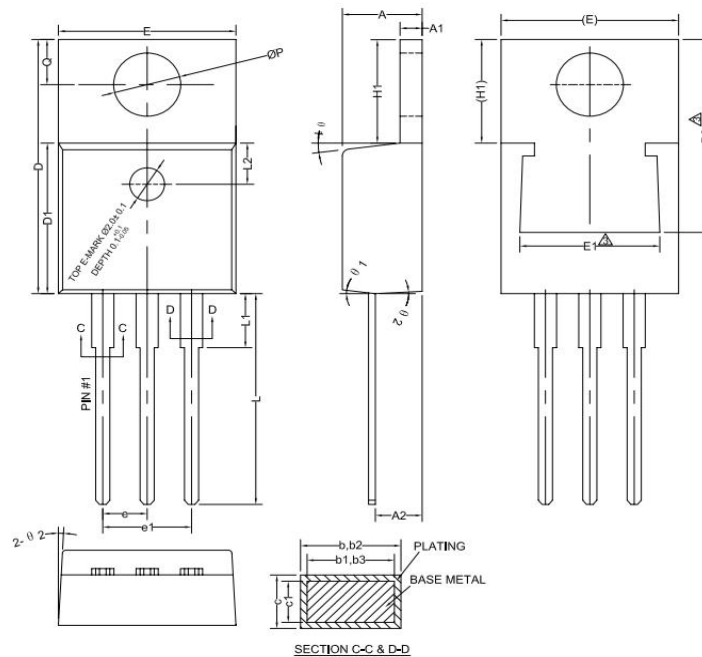
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.70
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.70	0.80	0.95
b1	-	1.28	-
c	0.45	0.50	0.65
D	15.67	15.87	16.07
D1	-	7.70	-
D2	-	9.12	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54		
e1	5.08		
F	2.1		
G	7		
H1	-	0.81	-
L	12.48	12.98	13.20
L1	-	2.93	-
ΦP1 (上口)	2.98	3.18	3.38
ΦP2 (下口)	3.20	3.40	3.60
Q	3.10	3.30	3.50
θ1	5°		
θ2	45°		
θ2	5°		
θ3	5°		

Mechanical Dimensions
TO-220F (Package 3)

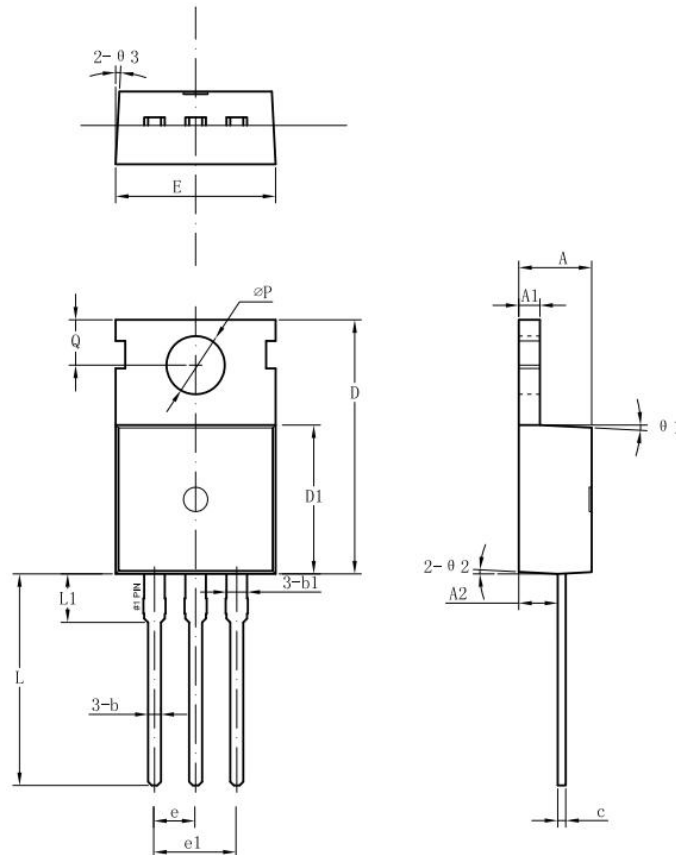
Unit: mm



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	2.60	2.80	2.95
A3	1.0REF		
b	0.75	0.80	0.85
b1	1.18	1.20	1.24
b2	1.18	1.24	1.30
c	0.45	0.50	0.55
D	15.67	15.87	16.07
D1	9.04	9.12	9.20
E	10.00	10.16	10.30
E1	9.94	10.06	10.30
E2	9.40	9.50	9.60
e	2.50	2.54	2.58
e1	5.08REF		
L	12.78	12.98	13.18
L1	2.70	2.92	3.20
L2	7.70	7.80	7.90
Q	6.50REF		
ΦP	3.08	3.18	3.28
ΦP1	1.45	1.55	1.65
ΦP2	0.95	1.15	1.35
ΦP3	3.30	3.40	3.50
θ1	3°	5°	7°
θ2	42°	45°	48°
F1	1.40	1.50	1.60
F2	13.80	13.90	14.00
F3	3.20	3.30	3.40
F4	3.70	3.90	4.10
G	7.80	8.00	8.20
G1	6.90	7.00	7.10
K1	0.65	0.70	0.75

Mechanical Dimensions
TO-220C (Package 1)
Unit: mm


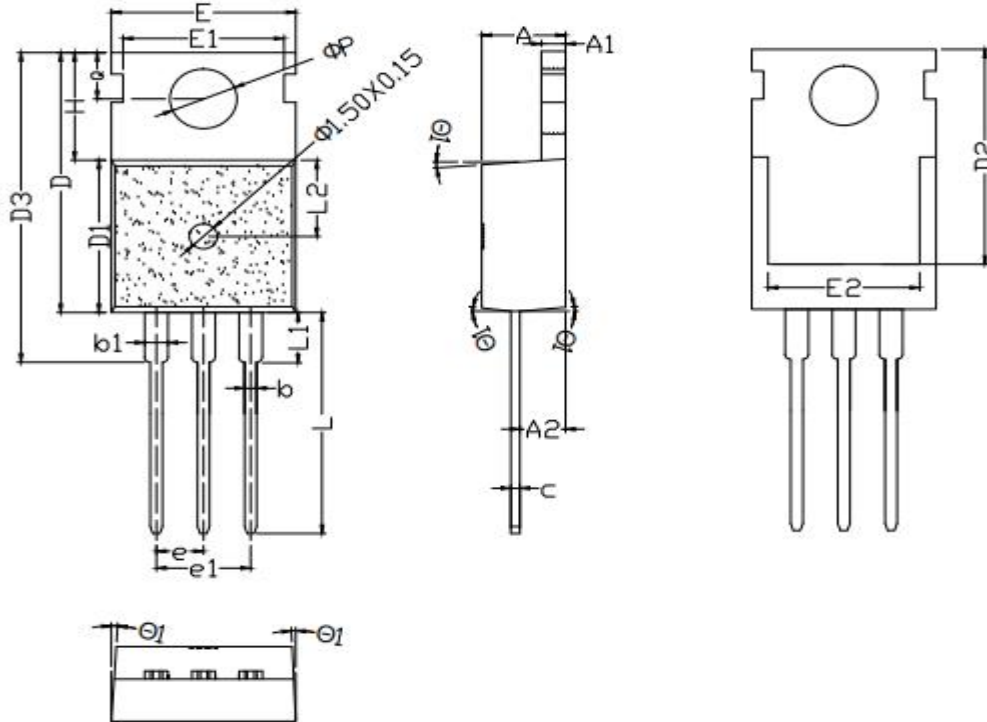
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.57	4.70
A1	1.22	-	1.32
A2	2.59	2.69	2.79
b	0.77	-	0.90
b1	0.76	0.81	0.86
b2	1.23	-	1.36
b3	1.22	1.27	1.32
c	0.34	-	0.47
c1	0.33	0.38	0.43
D	15.15	15.45	15.75
D1	9.05	9.15	9.25
D2	11.40	-	12.88
E	9.96	10.16	10.36
E1	6.86	-	8.89
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
H1	6.10	6.30	6.50
L	12.70	-	13.12
L1	-	-	3.90
ØP	3.80	3.84	3.88
Q	2.60	-	2.90
θ1	5°	7°	9°
θ2	1°	2°	5°

Mechanical Dimensions
TO-220C (Package 2)
Unit: mm


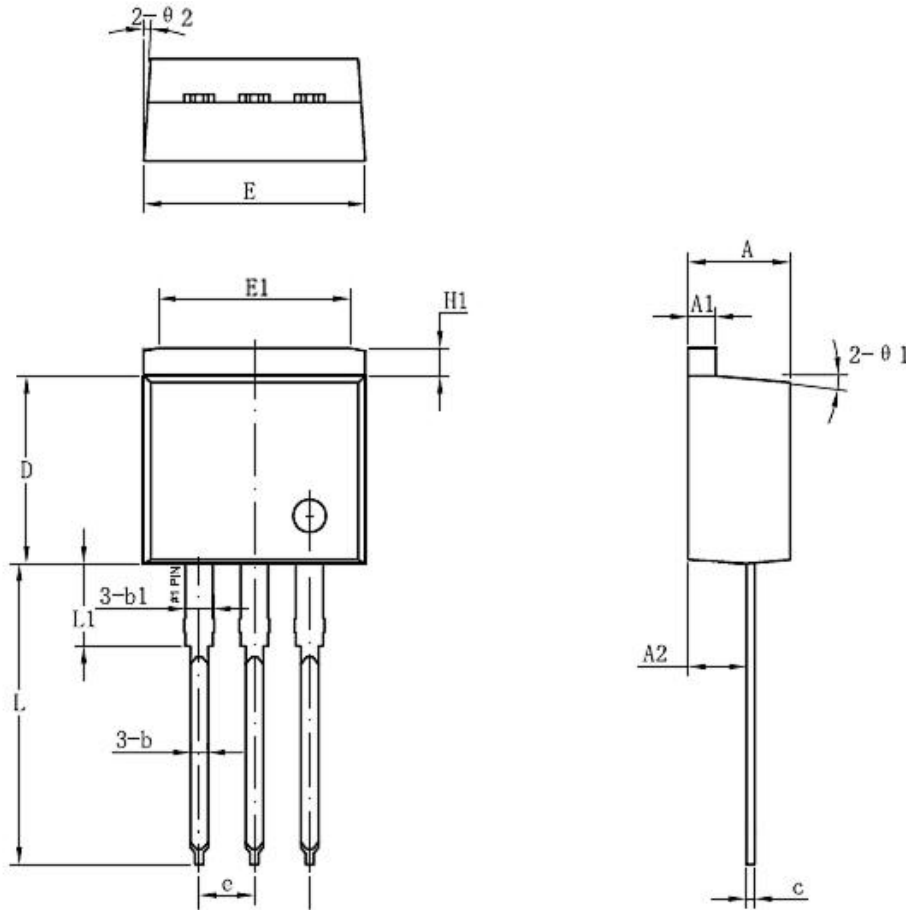
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.50	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b1	-	1.27	-
c	0.40	0.50	0.65
D	15.20	15.70	16.20
D1	9.00	9.20	9.40
E	9.70	10.00	10.20
e		2.54	
e1		5.08	
L	12.60	13.08	13.60
L1	-	3.00	-
ΦP	3.50	3.60	3.80
Q	2.60	2.80	3.00
θ1		3°	
θ2		3°	
θ2		3°	

Mechanical Dimensions
TO-220C (Package 3)

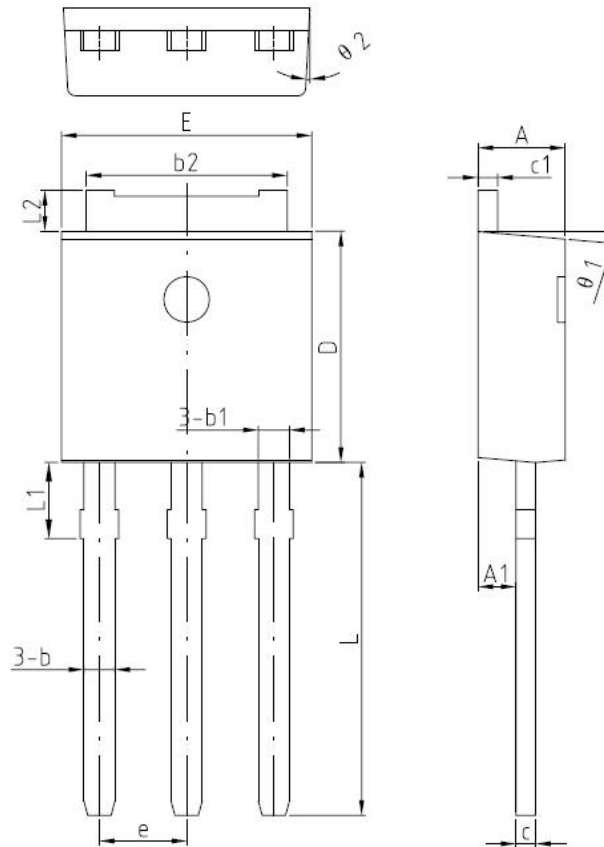
Unit: mm



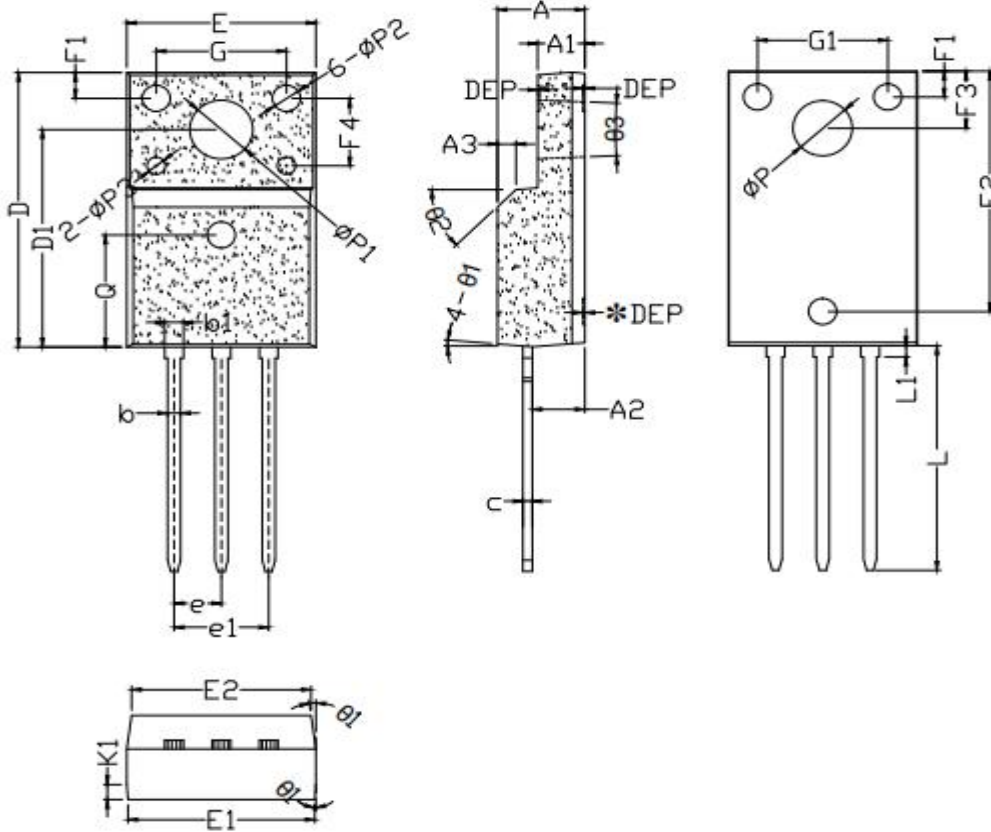
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.40	4.50	4.60
A1	1.25	1.30	1.35
A2	2.30	2.40	2.50
b	0.70	0.80	0.90
b1	1.25	1.33	1.42
c	0.45	0.50	0.55
D	15.50	15.75	16.00
D1	9.10	9.20	9.30
D2	12.90	13.10	13.30
D3	15.45	15.80	16.15
E	9.80	10.02	10.15
e	2.54BSC		
e1	5.08BSC		
L	13.00	13.28	13.45
L1	-	-	3.40
ΦP	3.55	3.65	3.75
Q	2.65	2.75	2.85
$\theta 1$	2°	-	7°
E1	8.55	8.70	8.85
E2	7.40	7.60	7.80
H	6.40	6.50	6.60
L2	4.50	4.65	4.80

Mechanical Dimensions
TO-262
Unit: mm


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.65	4.85
A1	1.17	1.27	1.40
A2	2.20	-	2.89
b	0.70	0.81	0.96
b1	-	1.27	-
c	0.36	0.40	0.61
D	8.55	-	9.4
E	9.80	10.10	10.31
E1	-	8.80	-
e	2.54(BSC)		
H1	1.00	1.25	1.40
L	12.60	-	14.08
L1	-	3.8	-
θ1		5°	
θ2		4°	

Mechanical Dimensions
TO-251
Unit: mm


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.40
A1	0.90	1.01	1.17
b	0.50	-	0.91
b1	-	0.81	-
b2	5.13	5.33	5.46
c	0.46	0.50	0.60
c1	0.46	0.50	0.60
D	5.95	6.10	6.25
E	6.45	6.60	6.75
e	2.286(BSC)		
L	9.00	9.30	9.60
L1	-	2.00	-
L2	0.90	-	1.25
θ1	-	5°	-
θ2	-	3°	-

Mechanical Dimensions
TO-220F Narrow
Unit: mm


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.60	4.70	4.80	E1	9.94	10.06	10.20
A1	2.34	2.54	2.74	E2	9.30	9.40	9.50
A2	2.56	2.76	2.93	F1	1.40	1.50	1.60
A3	1.0REF			F2	13.80	13.90	14.00
b	0.60	0.70	0.80	F3	3.20	3.30	3.40
b1	0.90	1.00	1.10	F4	3.70	3.90	4.10
c	0.45	0.50	0.55	G1	6.90	7.00	7.10
D	15.67	15.87	16.07	K1	0.65	0.70	0.75
D1	12.37	12.57	12.77	L	12.78	12.98	13.18
E	10.06	10.16	10.26	L1	-	-	0.85
e	2.50	2.54	2.58	Q	6.50REF		
e1	5.08REF			ΦP	3.08	3.18	3.28
ΦP1	3.30	3.40	3.50	ΦP3	0.90	1.00	1.10
ΦP2	1.40	1.50	1.60	θ1	3°	5°	7°
θ2	42°	45°	48°	θ3	3°	5°	7°
DEF	0.05	0.10	0.15				



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